

## **REMARKS/ARGUMENTS**

### **Overview of the Office Action**

Claims 1, and 3-5 have been rejected under 35 U.S.C. §102(b) as anticipated by “The Formation of Crystalline defects...” by Kawaguchi et al. (“Kawaguchi”).

Claims 2 and 6-12 have been rejected under 35 U.S.C. §103(a) as unpatentable over Kawaguchi in view of Applicants’ Admitted Prior Art (“AAPA”).

Claims 13-17 and 34 have been rejected under 35 U.S.C. §103(a) as unpatentable over Kawaguchi in view of “InGaN-Based Blue Light Emitting Diodes...” by Mukai (“Mukai”).

### **Status of the claims**

Claim 1 has been amended.

Claims 18-33 have been previously canceled.

Claims 1-17 and 34 remain pending.

### **Summary of subject matter disclosed in the specification**

The following descriptive details are based on the specification. They are provided only for the convenience of the Examiner as part of the discussion presented herein, and are not intended to argue limitations which are unclaimed.

The disclosed method for fabricating a light-emitting device includes forming at least one compound semiconductor layer based on gallium nitride and being an active layer or a part of an active layer sequence. The method further includes setting growth parameters used during production of the compound semiconductor layer such that, at least in some cases in a vicinity of

dislocations in the compound semiconductor layer, regions are produced in the compound semiconductor layer having a lower thickness than remaining regions of the compound semiconductor layer to build up a shielding energy barrier in the regions having the lower thickness.

#### Descriptive summary of Kawaguchi

Kawaguchi discusses the formation of crystalline defects and crystal growth mechanisms in  $\text{In}_x\text{Ga}_{1-x}\text{N}$  /GAN heterostructure grown by metalorganic vapor phase epitaxy. The composition pulling effect of  $\text{In}_x\text{Ga}_{1-x}\text{N}$  /GAN heterostructure is described in relation to lattice mismatch. Kawaguchi determines that the composition pulling effect at the initial growth stage occurred to reduce the lattice strain. As the layer thickness increased, the formation of defects decreased the lattice strain stored in the  $\text{In}_x\text{Ga}_{1-x}\text{N}$  /GAN layer owing to the lattice mismatch.

#### Claims 1 and 3-5 are allowable over Kawaguchi

The Office Action states that Kawaguchi teaches all of Applicants' recited elements.

Independent claim 1 has been amended to point out more clearly the subject matter that Applicants regard as the invention. Specifically, independent claim 1 has been amended to recite a method for fabricating a light-emitting device that includes forming at least one compound semiconductor layer based on gallium nitride and being an active layer or a part of an active layer sequence. The method further includes setting growth parameters used during production of the compound semiconductor layer such that, at least in some cases in a vicinity of dislocations in the compound semiconductor layer, regions are produced in the compound semiconductor layer that have a lower thickness than remaining regions of the compound

semiconductor layer to build up a shielding energy barrier in the regions having the lower thickness, where the shielding energy barriers suppress diffusion of charge carriers toward the dislocations.

Kawaguchi does not teach or suggest building up a shielding energy barrier in the regions having the lower thickness, where the shielding energy barriers suppress diffusion of charge carriers toward the dislocations.

According to Applicants' specification (see paragraph 0036 of the published specification), the Wurtzite structure of the group III nitrides and the strongly polar nature of the Ga/In/Al-nitrogen bond cause a piezoelectric field so that the effective band gap is highly dependent on the thickness of the light-emitting layer.

As the piezoelectric field causes the shielding energy barriers, the shielding energy barriers are reduced if the piezoelectric field is weakened (e.g., by an opposite electric field interfering with the piezoelectric field), which is what occurs according to Kawaguchi.

Kawaguchi teaches that the lattice mismatch between  $\text{In}_x\text{Ga}_{1-x}\text{N}$  and GaN leads to the effect that the indium mole fraction  $x$  becomes small at the initial growth stage of  $\text{In}_x\text{Ga}_{1-x}\text{N}$  grown on the GaN and AlGaIn epitaxial layers, whereas the crystalline quality deteriorates and the indium mole fraction increases, by increasing the layer thickness (see page 24, last paragraph to page 25, first paragraph). This means that in the vicinity of dislocations (i.e., in the regions of lower thickness), the indium mole fraction is higher than in the regions of greater thickness. As the band of  $\text{In}_x\text{Ga}_{1-x}\text{N}$  becomes smaller with an increasing indium mole fraction, an attractive potential, and consequently an electric field, which is opposite to the piezoelectric field, results. Therefore, the piezoelectric field is weakened by the opposite electric field. Thus, shielding energy barriers suppressing diffusion of charge carriers toward the dislocations are not

automatically built up in the vicinity of dislocations within the epitaxial layers disclosed by Kawaguchi, which is in contrast to the recitations in Applicant's amended independent claim 1.

In view of the foregoing, it is respectfully submitted that Kawaguchi does not teach or suggest the subject matter recited in Applicants' amended independent claim 1. Accordingly, claim 1 is patentable thereover under 35 U.S.C. §102(b).

Moreover, the significant above-discussed distinctions clearly render the claimed invention unobvious over Kawaguchi under 35 U.S.C. §103(a).

#### Dependent claims

Claims 3-5, which depend directly or indirectly from independent claim 1, incorporate all of the limitations of independent claim 1 and are, therefore, deemed to be patentably distinct over the Kawaguchi for at least those reasons discussed above with respect to independent claim 1.

#### Claims 2 and 6-12 are allowable over Kawaguchi in view of the AAPA under 35 U.S.C. §103(a)

The Office Action states that the combination of Kawaguchi and the AAPA teaches all of Applicants' recited elements.

Kawaguchi has been previously discussed and does not teach or suggest the invention recited in Applicants' independent claim 1.

Because Kawaguchi does not teach or suggest the subject matter recited in amended independent claim 1 and because the AAPA does not teach or suggest any elements of independent claim 1 that Kawaguchi is missing, the addition of the AAPA to the reference combination fails to adversely affect the non-obviousness of the claim.

Claims 2 and 6-12, which depend directly or indirectly from independent claim 1, incorporate all of the limitations of independent claim 1 and are, therefore, deemed to be patentably distinct over the Kawaguchi and the AAPA for at least those reasons discussed above with respect to independent claim 1.

Claims 13-17 and 34 are allowable over Kawaguchi in view of Mukai under 35 U.S.C. §103(a)

The Office Action states that the combination of Kawaguchi and Mukai teaches all of Applicants' recited elements.

Kawaguchi has been previously discussed and does not teach or suggest the invention recited in Applicants' independent claim 1.

Because Kawaguchi does not teach or suggest the subject matter recited in amended independent claim 1 and because Mukai does not teach or suggest any elements of independent claim 1 that Kawaguchi is missing, the addition of Mukai to the reference combination fails to adversely affect the non-obviousness of the claim.

Claims 13-17 and 34, which depend directly or indirectly from independent claim 1, incorporate all of the limitations of independent claim 1 and are, therefore, deemed to be patentably distinct over the Kawaguchi and Mukai for at least those reasons discussed above with respect to independent claim 1.

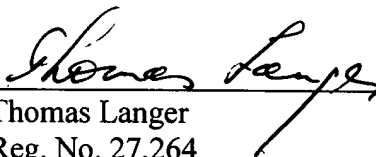
#### Conclusion

In view of the foregoing, reconsideration and withdrawal of all rejections, and allowance of all pending claims is respectfully solicited.

Should the Examiner have any comments, questions, suggestions, or objections, the Examiner is respectfully requested to telephone the undersigned in order to facilitate reaching a resolution of any outstanding issues.

Respectfully submitted,

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